The Fabrication of Ultra-Lightweight Full-Shell X-ray Optics by 3D-Printing

Completed Technology Project (2017 - 2018)

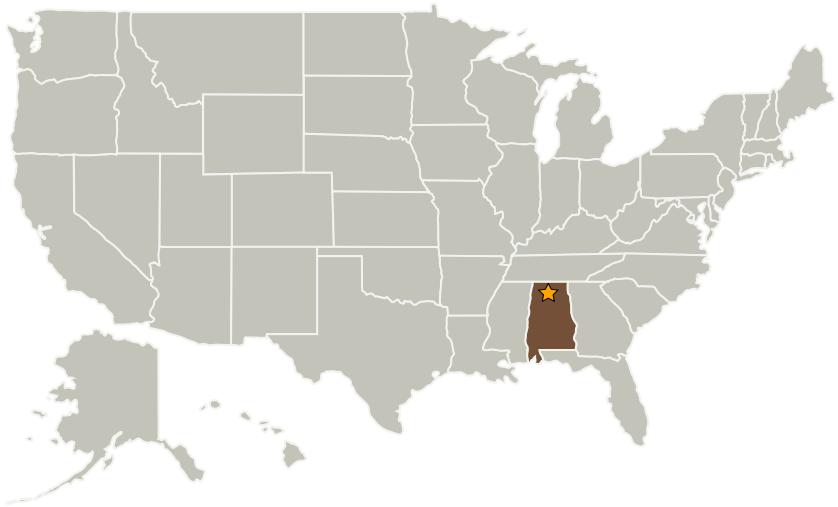
Project Introduction

The proposal seeks to demonstrate printing of material directly onto a precisely figured mandrel in order to eliminate secondary forming and polishing steps after the printing process. The first process is to electroform a very thin (i.e., 50 micron) layer of Ni onto a mandrel. Afterward the ceramic is printed onto the electroformed nickel, heat treated at low temperature, and then released. The second approach is to use a thin film release layer such as Titanium Nitride (TiN) which is deposited on the mandrel prior to printing of the ceramic. After printing the ceramic is heat treated at low temperature and then released.

Anticipated Benefits

The proposal offers a new approach to X-ray optics fabrication by replacing a portion of the thickness of traditional NiCo electroformed optics with a lightweight printed ceramic. This approach offers the potential to achieve a larger collecting area for a given mass budget in comparison to traditional electroformed optics.

Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
★Marshall Space Flight Center(MSFC)	Lead Organization	NASA Center	Huntsville, Alabama

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Primary U.S. Work Locations
Alabama

Project Website:

https://www.nasa.gov/directorates/spacetech/home/index.html

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Center / Facility:

Marshall Space Flight Center (MSFC)

Responsible Program:

Center Innovation Fund: MSFC CIF

Project Management

Program Director:

Michael R Lapointe

Program Manager:

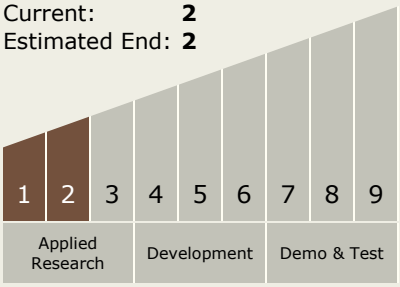
John W Dankanich

Principal Investigator:

David M Broadway

Technology Maturity (TRL)

Start: **1**
Current: **2**
Estimated End: **2**



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Technology Areas

Primary:

- TX12 Materials, Structures, Mechanical Systems, and Manufacturing
  - TX12.4 Manufacturing
    - TX12.4.1 Manufacturing Processes

Target Destinations

Outside the Solar System, Others Inside the Solar System